TITLE OF THE INVENTION

WRAPPER PAPER FOR SMOKING ARTICLES DECREASING THE AMOUNT OF VISIBLE SIDESTREAM SMOKE OF TOBACCO

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a Continuation Application of PCT Application No. PCT/JP02/04650, filed May 14, 2002, which was not published under PCT Article 21(2) in English.

This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2001-146537, filed May 16, 2001, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a wrapper paper for a smoking article, which decreases the amount of visible sidestream smoke of tobacco.

2. Description of the Related Art

A low sidestream smoke cigarette having a small amount of a sidestream smoke generated has been developed in recent years. Whether or not such a cigarette actually has a small amount of the sidestream smoke generated is determined by a so-called fishtail method. The fishtail method is described in detail in Japanese Patent Disclosure (Kokai) No. 10-81 with reference to drawings. Briefly stated, the

fishtail method utilizes a smoke chamber having an open lower end portion, which is shaped like a fishtail. A Cambridge filter having a diameter of 44 mm is mounted on an upper portion of the smoke chamber. A prescribed length of a cigarette is subjected to a static burn in the lower end portion of the smoke chamber while sucking the air at a rate of 3 liters/min through the upper end portion of the smoke chamber. The particulate matter contained in the sidestream smoke that is generated in this stage is allowed to be attached to the Cambridge filter and to the inner wall of the smoke chamber, and the mass of the attached particulate matter is measured. To be more specific, the mass of the original Cambridge filter is subtracted from the mass of the Cambridge filter catching the particulate matter so as to obtain first the mass of the particulate matter attached to the Cambridge filter. Then, each of the particulate matter attached to the Cambridge filter and the particulate matter attached to the inner wall of the smoke chamber is extracted with a solvent so as to measure the absorbance. Further, the mass of the particulate matter attached to the inner wall of the smoke chamber is calculated from the ratio of absorbance values thus obtained and from the mass of the particulate matter attached to the Cambridge filter calculated first (i.e., the value obtained by the subtraction referred

to above). The sidestream smoke amount per cigarette (mg/cig) is obtained by adding the mass of the particulate matter attached to the Cambridge filter to the mass of the particulate matter attached to the inner wall of the smoke chamber. Also, the sidestream smoke amount per unit time (mg/min) is obtained in this method by measuring the time required for the static burn of a prescribed length of the cigarette and by dividing the sidestream smoke amount per cigarette by the time thus measured. In the development of the conventional low sidestream smoke cigarette, the sidestream smoke amount per unit time thus obtained was regarded as approximating the apparent sidestream smoke amount.

On the other hand, an apparatus is proposed for consecutively or instantly measuring the sidestream smoke amount of the cigarette by an optical method without relying on measurement of mass (Japanese Patent Disclosure No. 3-120444). In this optical apparatus, the sidestream smoke generated from a cigarette burnt within a burn chamber is irradiated with a light flux, and the intensity of the light flux transmitted through the sidestream smoke is measured. The light flux intensity thus measured corresponds to the concentration of the sidestream smoke and, thus, reflects the amount of all the particulate matter.

It has been found, however, that, when it comes

to the cigarettes which permit suppressing the amounts of the sidestream smoke to an equally low level when evaluated by the mass of all the particulate matter as in the fishtail method, the amounts of the sidestream smoke often differ from each other when actually measured visually in the smoking stage. This supports that the amount of the sidestream smoke measured by the mass of all the particulate matter does not necessarily correspond to the amount of the sidestream smoke measured by the visual observation. Since the optically measured amount of the sidestream smoke referred to above also corresponds to the concentration of the sidestream smoke, it is reasonable to state that the optically measured amount of the sidestream smoke does not necessarily correspond to the amount of the sidestream smoke measured by the visual observation.

It is desirable for the smoking article such as a cigarette to be small not only in the mass of all the particulate matter but also in the amount of the sidestream smoke actually measured by the visual observation.

Under the circumstances, an object of the present invention is to provide a wrapper paper for a smoking article, which can decrease the amount of sidestream smoke measured by the visual observation (sometimes referred to also as an amount of the visible sidestream smoke hereinafter).

BRIEF SUMMARY OF THE INVENTION

As a result of an extensive research that has been made in an attempt to achieve the object referred to above, the present inventors have found that the amount of the visible sidestream smoke can be markedly lowered by mixing calcium carbonate in a prescribed amount and a burn adjusting agent in a prescribed amount in the wrapper paper for a smoking article. The present invention has been achieved on the basis of the finding.

Thus, the present invention provides a wrapper paper for a smoking article, which decreases an amount of visible sidestream smoke of tobacco, the wrapper paper containing at least 30 g/m^2 of calcium carbonate and at least 3% by mass of a burn adjusting agent.

In the present invention, the burn adjusting agent is preferably selected from the group consisting of potassium citrate and sodium citrate.

Also, in the present invention, it is desirable for the ash component in the surface layer on at least one side of the wrapper paper to be not larger than 35% by mass and for the ash component in the surface layer on each of the top side and the bottom side of the wrapper paper to be not larger than 35% by mass.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is an oblique view schematically showing the construction of an apparatus used in the present

invention for measuring the amount of the visible sidestream smoke for a smoking article;

FIG. 2 is a block diagram schematically showing the construction of an apparatus used in the present invention for measuring the amount of the visible sidestream smoke for a smoking article;

FIG. 3 schematically shows the construction of an apparatus for evaluating the amount of the visible sidestream smoke that can be used in the organoleptic inspection;

FIG. 4 is a graph showing the relationship between the amount of the visible sidestream smoke measured by the visual observation and the value detected by using the apparatus for measuring the amount of the visible sidestream smoke shown in FIG. 1;

FIG. 5 is a graph showing the result of the measurement of the amount of the visible sidestream smoke by the fishtail method in respect of a cigarette wrapped in a wrapper paper for Example 1 described herein later;

FIG. 6 is a graph showing the result of the measurement of the amount of the visible sidestream smoke by the apparatus shown in FIG. 1 in respect of a cigarette wrapped in a wrapper paper for Example 1 described herein later;

FIG. 7 is a graph showing the result of the measurement of the amount of the sidestream smoke by

the fishtail method in respect of a cigarette wrapped in a wrapper paper for Example 2 described herein later;

FIG. 8 is a graph showing the result of the measurement of the amount of the visible sidestream smoke by the apparatus shown in FIG. 1 in respect of a cigarette wrapped in a wrapper paper for Example 2 described herein later;

FIG. 9 is a graph showing the result of the measurement of the amount of the sidestream smoke by the fishtail method in respect of a cigarette wrapped in a wrapper paper for Example 3 described herein later; and

FIG. 10 is a graph showing the result of the measurement of the amount of the visible sidestream smoke by the apparatus shown in FIG. 1 in respect of a cigarette wrapped in a wrapper paper for Example 3 described herein later.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will now be described more in detail.

Pulp used for a wrapper paper for a smoking article according to the present invention is comprised of a flax pulp, a wood pulp or the like pulp used for an ordinary wrapper paper for smoking articles (particularly cigarettes). It is practical to use the pulp in an amount sufficient to maintain the mechanical

strength required for the paper making process or for the wrapping of the tobacco. Preferably, the pulp amount is 20 to 50 g/m^2.

The wrapper paper for a smoking article according to the present invention contains at least a prescribed amount of calcium carbonate and is added with at least a prescribed amount of a burn adjusting agent. The calcium carbonate is contained in an amount of 30 g/m^2 or more and 50 g/m^2 or less, and the burn adjusting agent is added in an amount of 3 to 15% by mass. Where the amount of calcium carbonate is smaller than 30 g/m^2 and/or where the amount of the burn adjusting agent is smaller than 3 mass %, a sufficient effect of suppressing the amount of the visible sidestream smoke may not be obtained.

Calcium carbonate is added in the form of particles. It is desirable for the particle diameter of calcium carbonate, which can be selected appropriately in view of the cost and the convenience in the paper making process, to fall within a range of 0.02 μm to 10 μm.

It is desirable for the wrapper paper to have a basis weight of 50 g/m^2 to 100 g/m^2.

It is desirable to use an alkali metal salt of citric acid as the burn adjusting agent. Particularly, it is desirable to use potassium citrate and sodium citrate as the burn adjusting agent. Potassium

citrate and sodium citrate can be used singly or in combination.

It should be noted that, in the paper internally added with a loading material, which is manufactured by the Fourdrinier machine, the amount of the loading material on the wire side is rendered smaller than that on the felt side in accordance with the dehydration from the wire side in the paper layer-forming stage. As a result, a bias is generated in the distribution of the loading material and the fiber in the paper in the thickness direction of the paper (or in the Z-direction). It follows that the paper is caused to have bilateral properties. It is possible for the bilateral properties to bring about defects in terms of the printing quality and the characteristics of the paper in the field of the printing paper. However, in the conventional wrapper paper, the bilateral properties are desirable in terms of the convergence of the ash in the burn stage of the cigarette, and the other influences scarcely lead to a practical problem.

However, if a wrapper paper containing a very large amount of the loading material as in the present invention is manufactured by the conventional Fourdrinier machine, the loading material contained in a large amount in the surface on the felt side is dropped during the manufacturing process of the cigarette so as to promote the generation of problems

such as the paper powder trouble and the wrapping defect. It follows that the manufacture of the cigarette at a high speed is caused to be impaired.

For overcoming the problem described above, it is necessary to decrease the loading material alone distributed in the vicinity of the surface while maintaining the amount of the loading material contained within the wrapper paper. As a means for decreasing the loading material alone distributed in the vicinity of the surface while maintaining the amount of the loading material contained within the wrapper paper, it is possible to use a paper making machine in which the paper layer is formed by a double-side dehydration type wire part. The double-side dehydration type wire part denotes a twin wire type wire part. Such a paper making machine includes a twin wire machine, or a paper making machine provided with a wire pat which is a so-called on-top type wire or hybrid wire in which a twin wire is used in a part of a Fourdrinier machine. In the general Fourdrinier machine, the dehydration is carried out on the wire side alone in the stage of forming a paper layer. In the twin wire type machine, however, the paper layer is formed by the dehydration from two wires in contact with the upper and lower surfaces of the paper material used for the paper making so as to make it possible to decrease the amount of the loading material contained

in the surface region of the wrapper paper. The wrapper paper manufactured by the general Fourdrinier machine has the highest loading material content on the felt surface, and the loading material content is gradually lowered toward the wire surface. On the other hand, in the wrapper paper manufactured by the twin wire type paper making machine, the difference in the content of the loading material between the inner region and the surface region of the paper layer is small and, thus, the difference in the loading material content between the entire paper layer and each layer is considerably small. Incidentally, in the present invention, the region in the thickness direction from the surface of the wrapper paper, which corresponds to 18 to 20% by mass of the entire mass of the wrapper paper, is defined as the surface layer, and the ash component in the particular region is defined as the ash component of the surface layer. Also, where the wrapper paper is manufactured by the conventional Fourdrinier machine, the front and back surfaces of the manufactured wrapper paper are generally called the surface on the felt side and the surface on the wire side, respectively. On the other hand, where the wrapper paper is manufactured by the twin wire type paper making machine, the front and back surfaces of the manufactured wrapper paper are called the surface on the top wire side and the surface on the bottom wire

side, respectively. In the present invention, the felt side and the top wire side are called the top side, and the wire side and the bottom wire side are called the bottom side. In the present invention, it is desirable for the ash component in at least one surface layer on the top side or the bottom side of the wrapper paper to be not larger than 35% by mass, and it is more desirable for the ash component in the surface layer on each of the top side and the bottom side of the wrapper paper to be not larger than 35% by mass.

It should be noted that, for determining the ash component in the surface layer, the wrapper paper sample is divided into several sections in the thickness direction of the wrapper paper sample, and the ash component in the surface layer corresponding to 18 to 20% by mass of the entire mass in the thickness direction from the surface of the sample can be determined in accordance with JIS P 8128. Briefly stated, the ash component in the surface layer noted above is determined as follows.

A sample sized at 40 mm × 200 mm is taken from a wrapper paper, and the mass of the sample is measured. Then, an adhesive tape (width of 50 mm, tesa #4267) is attached to the surface of the sample such that an air layer is not formed over the entire region of the sample ranging between one edge and the other edge of the sample. After those regions of the adhesive tape

which overhang the sample are cut off, load is applied from above the adhesive tape so as to cause the adhesive tape to be attached strongly to the sample. The mass of the sample having the adhesive tape attached thereto is measured again so as to obtain the mass of the adhesive tape. Then, another adhesive tape is attached to the opposite surface of the sample, and the sample sandwiched between the two adhesive tapes is divided in its longitudinal direction into two sections by utilizing the adhesive force of the adhesive tapes. To be more specific, the sample is divided by the T-shaped peeling, in which the sample sandwiched between the two adhesive tapes is held vertical and is slowly peeled in the horizontal direction at a constant speed. An additional adhesive tape is attached again to the peeling surface of the sample subjected to the first peeling process, and the similar procedure is repeated until the mass of the surface layer amounts to 18 to 20% by mass of the mass of the original sample. Ten points per sample of the surface layer thus obtained are strongly heated at 900℃ together with the adhesive tape so as to obtain the ash component in accordance with JIS P 8128, and the ash component thus obtained is corrected by the ash component of the adhesive tape so as to obtain the value of the ash component of the surface layer. Also, the ash component of the sample before the division of the

sample is also measured separately so as to obtain the total ash component.

The wrapper paper for a smoking article (particularly, cigarette) according to the present invention permits markedly decreasing the amount of the visible sidestream smoke of tobacco, compared with the conventional wrapper paper. The measurement of the amount of the visible sidestream smoke, which can be performed by the organoleptic inspection, can also be performed easily by using an apparatus for measuring the amount of the visible sidestream smoke disclosed in Japanese Patent Application No. 2000-268910.

FIG. 1 is an oblique view schematically showing the construction of an apparatus for measuring the amount of the visible sidestream smoke disclosed in Japanese Patent Application No. 2000-268910, and FIG. 2 is a block diagram schematically showing the construction of the apparatus for measuring the amount of the visible sidestream smoke referred to above.

As shown in FIGS. 1 and 2, the apparatus 10 for measuring the amount of the visible sidestream smoke comprises a static burn chamber 11 for a smoking article, a visible light irradiating unit 12 for irradiating the sidestream smoke generated by the static burn of the smoking article and naturally rising upward within the static burn chamber 11 with a prescribed visible light beam in a direction

substantially perpendicular to the flowing direction of the sidestream smoke, and a scattered light intensity detecting unit 14 for detecting, as the index of the amount of the visible sidestream smoke, the intensity of the scattered light scattered by the sidestream smoke in a direction substantially perpendicular to the direction of the visible light beam.

The static burn chamber 11 is formed of a light shielding material, and is comprised of, for example, a hollow parallelepiped body having a longer side in the vertical direction and defined by four side walls 11a to 11d. A smoking article insertion port 111 for inserting a smoking article SA such as an ignited cigarette into the static burn chamber 11 is formed in a lower portion of the side wall 11a. Air flowing windows 112 to 115 such as mesh windows, which permit supplying the air required for the static burn of the smoking article SA into the static burn chamber 11, are formed in the lowermost end portions of the four side walls 11a to 11d defining the static burn chamber 11. It is desirable for the insertion port 111 of the smoking article to be formed such that the sidestream smoke SSS generated from the smoking article SA inserted into the static burn chamber 11 through the insertion port 111 is prevented from being affected by the disturbance of the external air entering the static burn chamber 11 through the air flowing windows 112 to

115 and to be positioned such that the distance between the smoking article SA and the upper edge of the static burn chamber 11 is long enough to prevent substantially the sidestream smoke SSS from being swayed.

It is possible to load glass beads (not shown) in the free space in the bottom portion of the static burn chamber 11 surrounded by the air flowing windows 112 to 115 so as to form an air flow rectifying layer, thereby preventing the sidestream smoke SSS rising upward within the static burn chamber 11 by the static burn of the smoking article from being disturbed. The upper end of the static burn chamber 11 is left open. It is possible to mount an evacuating hood 15 on the open upper end of the static burn chamber 11 for evacuating the static burn chamber 11. It is necessary to evacuate the static burn chamber 11 such that the static burn of the smoking article SA is not substantially affected. For evacuation, it is desirable to mount a flow rectifying filter 16 in a manner to cross the upper open end of the static burn chamber 11 so as to not to disturb the sidestream smoke SSS naturally rising upward within the static burn chamber 11 by the static burn of the smoking article. An evacuating duct 151 is mounted on the top portion of the evacuating hood 15, and the evacuating duct 151 is connected to an evacuating system (not shown).

The visible light irradiating unit 12 is mounted

outside the static burn chamber 11. In the example shown in the drawing, the visible light irradiating unit is mounted outside the side wall 11b facing the side wall 11a of the static burn chamber 11 into which the smoking article SA is inserted. A visible light transmitting window 116 is formed in that portion of the side wall 11b which is positioned to face the visible light irradiating unit 12. The visible light irradiating unit 12 comprises a visible light source (not shown) and serves to irradiate the sidestream smoke SSS generated by the static burn of the smoking article SA and naturally rising upward within the static burn chamber 11 with a visible light beam VLB in a direction substantially perpendicular to the flowing direction of the sidestream smoke. The visible light source used is not particularly limited as far as a visible light can be emitted. For example, it is possible to use a visible light laser, a visible light emitting diode, or a halogen lamp as the visible light source. In the typical case, a light source A stipulated by the International Illumination Committee is used as the visible light source.

The visible light beam (visible light flux) VLB emitted from the visible light irradiating unit 12 has a substantial cross section large enough to cover sufficiently the sidestream smoke SSS naturally rising upward within the static burn chamber 11 even if the

sidestream smoke SSS is somewhat swayed. For example, it is possible for the visible light beam VLB to have a width w in a direction perpendicular to the irradiating direction (FIG. 2) and to have a rectangular cross section having a height in a direction substantially perpendicular to the irradiating direction of the visible light beam VLB so as to conform with the view field in performing the organoleptic evaluation in view of the view field of the human being. It is desirable for the width w to be at least equal to the swaying width of the visible sidestream smoke SSS in a direction perpendicular to the irradiating direction of the visible light beam. Incidentally, the cross sectional shape of the visible light beam is not limited to a rectangular shape. The cross sectional shape of the visible light beam may be elliptical, circular, etc. The shaping of the visible light beam can be effected by the known method. For example, it is possible to use a mask having an aperture conforming to the cross sectional shape of the visible light beam. It is also possible to use a lens system including a convex lens and a concave lens used in combination.

It is desirable to arrange a light absorption unit 13 outside the static burn chamber 11, in the example shown in FIG. 1, outside the sidewall 11a, such that the light absorption unit 13 is positioned to face the visible light irradiating unit 12, to permit all

the light components generated from the visible light irradiating unit 12 and transmitted through the sidestream smoke SSS to be absorbed and removed. A visible light transmitting window 117 is formed in that portion of the side wall 11a which is positioned to face the light absorption unit 13.

The scattered light intensity detecting unit 14 is arranged outside the static burn chamber 11 in a direction perpendicular to the direction of the irradiating light beam emitted from the visible light irradiating unit 12. In the example shown in FIG. 1, the scattered light intensity detecting unit is arranged outside the side wall 11d. A visible light transmitting window 118 is arranged in that portion of the side wall 11d which is positioned to face the scattered light intensity detecting unit 14. As described previously, the scattered light intensity detecting unit 14 serves to detect the intensity of the scattered light SLV (90°-scattered light), which is scattered in a direction substantially perpendicular to the irradiating direction of the visible light beam VLB, among the light beams irradiating the sidestream smoke SSS and scattered by the sidestream smoke SSS. The scattered light intensity detecting unit 14 comprises an optical system (not shown) for converging the 90°-scattered light SLV and a light-electricity conversion device (not shown), known per se, for

converting the converged 90°-scattered light SLV into an electric signal and outputting the electric signal. A photomultiplier for converting the light into a voltage signal can be used desirably as the light-electricity conversion device referred to above. The converted voltage signal is subjected to, for example, an A/D conversion and, then, can be used for the data sampling using a personal computer. The data acquisition interval and the acquisition time can be set optionally. Typically, 300 points can be measured at an interval of 0.2 second in one minute.

The intensity of the detected 90°-scattered light SLV and the amount of the visible sidestream smoke correlate very well to each other. Therefore, it is possible to judge that the amount of the visible sidestream smoke is rendered relatively large with increase in the intensity of the detected 90°-scattered light. Incidentally, it has been found that the intensity of the 90°-scattered light and the amount of all the particulate matter contained in the sidestream smoke do not correlate to each other.

In order to prevent the external stray light from being incident from each of the visible light transmitting windows, it is desirable to arrange external stray light shielding boxes 17 to 19 between the visible light irradiating unit 12 and the visible light transmitting window 116, between the light

absorption unit 13 and the visible light transmitting window 117, and between the scattered light intensity detecting unit 14 and the visible light transmitting window 118.

Concerning the typical examples of the entire size of the apparatus 10, the static burn chamber 11 is a hollow parallelepiped having a cross section sized at 11 cm × 11 cm and a height of 80 cm. The smoking article insertion port 111 is formed at a position 50 cm apart from the lower edge of the static burn chamber. The distance between the smoking article SA and the center of the visible light beam is 10 cm. Further, the visible light beam emitted from the visible light beam irradiating unit has a cross sectional area sized at 5 cm × 5 cm.

As shown in FIG. 2, it is desirable for the apparatus for measuring the amount of the visible sidestream smoke used in the present invention to comprise a conversion table means 20 for converting the intensity of the 90°-scattered light detected by the scattered light intensity detecting unit 14 into the amount of the visible sidestream smoke based on the relationship between the intensity of the 90°-scattered light and the amount of the visible sidestream smoke measured by the visual observation and for outputting the converted amount of the visible sidestream smoke. The relationship obtained in advance between the

intensity of the 90°-scattered light and the amount of the visible sidestream amount obtained by the visual observation is inputted in the conversion table means 20 as a conversion formula, a calibration curve, etc., so as to permit the intensity signal of the 90°-scattered light outputted from the scattered light intensity detecting unit 14 to be converted into the amount of the visible sidestream smoke. The amount of the visible sidestream smoke thus converted is generated from the conversion table means 20. In order to obtain the correlation between the intensity of the 90°-scattered light and the amount of the visible sidestream smoke measured by the visual observation, the amount of the visible sidestream smoke of the smoking article such as a large number of cigarettes is evaluated by the organoleptic inspection by the pair test so as to determine numerically the amount of the visible sidestream smoke. The intensity of the 90°-scattered light detected by the apparatus is measured in respect of the same smoking article. It is possible to obtain a calibration curve by plotting the measured values in a graph comprising the ordinate directed to, for example, the amount of the visible sidestream smoke and the abscissa directed to, for example, the intensity of the 90°-scattered light. It is possible to obtain the conversion formula from the intensity of the 90°-scattered light into the

amount of the visible sidestream smoke on the basis of the calibration curve thus obtained.

The organoleptic inspection by the pair test can be performed by using, for example, an apparatus for evaluating the amount of the visible sidestream smoke shown in FIG. 3. To be more specific, a standard cigarette CIG1 and a target cigarette CIG2 are subjected to the static burn within two static burn chambers 31 and 32, respectively, which are arranged in symmetry in the right-left direction. In this case, a question-and-answer system is employed in which the observed amount of the sidestream smoke generated from the target cigarette CIG2 is asked to be evaluated numerically within a range of point 0 to point 10 relative to point 5 given to the standard cigarette CIG1. The static burn chambers 31 and 32 are provided with peeping windows 311 and 321, respectively, each having a prescribed width in the vertical direction. Also, visible light sources 33 and 34 are provided in the upper portions of the static burn chambers 31 and 32, respectively. It is desirable for the width of each of the peeping windows 311 and 321 in the vertical direction to correspond to the height of the visible light beam emitted from the visible light irradiating unit 12 included in the apparatus for measuring the amount of the visible sidestream smoke. It is also desirable for the distance between the cigarettes CIG1,

CIG2 and the lower ends of the peeping windows 311, 321 to correspond to the distance of the lower end of the visible light beam emitted from the visible light irradiating unit 12 included in the apparatus for measuring the amount of the visible sidestream smoke as measured from the smoking article SA. Side stream smokes SS1 and SS2 are irradiated from above with the visible light beams emitted from the visible light sources 33 and 34, and these sidestream smokes SS1 and SS2 can be observed through only the peeping windows 311 and 321.

The present invention will now be described more in detail with reference to Examples of the present invention, though the present invention is not limited by the following Examples.

Reference Example 1

Values corresponding to the amounts of the visible sidestream smoke generated from 15 kinds of cigarettes were evaluated by the organoleptic inspection by the pair test referred to previously. The evaluation was performed by 10 panelists by using the apparatus for evaluating an amount of the visible sidestream smoke shown in FIG. 3. The average value of the obtained points for each kind of the cigarettes was defined as the point of the cigarette of the particular kind. Also, the above values were normalized by defining as 1 the value corresponding to the amount of the visible

sidestream smoke generated from the cigarette that acquired the highest point. On the other hand, the intensity of the 90°-scattered light was detected as the voltage in respect of the amounts of the sidestream smoke of the same 15 kinds of the cigarettes by using the apparatus for measuring the amount of the visible sidestream smoke of the cigarette shown in FIG. 1, and the voltage values of the cigarettes were normalized such that the voltage data of the cigarette that was defined as 1 in the organoleptic inspection referred to previously would become 1. These data are plotted in a graph of FIG. 4 comprising the abscissa directed to the normalized intensity of the scattered light and the ordinate directed to the normalized value corresponding to the amount of the sidestream smoke measured by the organoleptic inspection. As apparent from FIG. 4, the intensity of the 90°-scattered light obtained by the apparatus for measuring the amount of the visible sidestream smoke correlates very well to the amount of the visible sidestream smoke measured by the organoleptic inspection.

Example 1

Wrapper papers were prepared, having a pulp in an amount of 30 g/m^2, and containing about 4.5% by mass of potassium citrate with amounts of calcium carbonate varied as shown in Table 1. Flax pulp was used as the pulp, and calcite type spindle-shaped calcium carbonate

having a particle diameter of 3.0 μm was used as the calcium carbonate. Cigarettes were prepared by using the resultant wrapper paper. The prepared cigarette had an ordinary FK size, in which the circumferential length was 4.9 mm, the tobacco column length was 59 mm, the filter length was 25 mm, and the chip paper length was 32 mm. The shredded tobacco used was of the ordinary American blend type used in the cigarette available on the market, and its loading amount was 0.580 g/cigarette. These cigarettes were conditioned at a temperature of 22℃ and a relative humidity of 60%, followed by the weight selection with the weight of a single cigarette set at 0.885±0.01 g. Then, the cigarette was tested.

Each of the selected cigarettes was subjected to the static burn with the burn length set at 49 mm. Table 1 also shows the burn time, the amount of the sidestream smoke per cigarette, and the amount of the sidestream smoke per unit time, measured by the fishtail method. The amount of the sidestream smoke per cigarette is also shown in FIG. 5. Also, the amount of the visible sidestream smoke generated from each cigarette was measured by using the apparatus shown in FIG. 2, with the result as shown in Table 1 and FIG. 6. The experimental data support that, where the amount of calcium carbonate is small, the amount of the sidestream smoke per cigarette is large (FIG. 5).

However, since the burn time is prominently long, the amount of the sidestream smoke per unit time determined by the fishtail method is small. On the other hand, where the amount of calcium carbonate is large, the burn time is short. Although the amount of the sidestream smoke per unit time is small because the amount of the sidestream smoke per cigarette is prominently small, the amount of the sidestream smoke per unit time determined by the fishtail method is not changed prominently. On the other hand, the experimental data given in FIG. 6 support that the amount of the visible sidestream smoke can be rapidly lowered if the wrapper paper is allowed to contain calcium carbonate in an amount of at least 30 g/m^2.

Table 1

Wrapper paper	Amount of calcium carbonate (g/m^2)	Amount of burn adjusting agent (%)	Fish tail method			Amount of visible sidestream smoke
			Burn time sec/49 mm	Amount of sidestream smoke mg/cig	Amount of sidestream smoke mg/min.	
1-1	10	4.4	406	16.6	2.45	0.70
1-2	15	4.4	388	16.4	2.53	0.66
1-3	20	4.5	377	16.5	2.63	0.66
1-4	25	4.6	365	15.9	2.62	0.64
1-5	30	4.5	357	15.4	2.59	0.50
1-6	35	4.6	352	14.8	2.52	0.49
1-7	40	4.6	349	14.0	2.40	0.46

Example 2

Wrapping papers were prepared by adding varied amounts of potassium citrate as shown in Table 2 to the wrapper paper containing 35 g/m^2 of calcium carbonate which was found to permit markedly decreasing the amount of the visible sidestream smoke in Example 1. The other conditions were the same as those for Example 1. Table 2 also shows the burn time, the amount of the sidestream smoke per cigarette, and the amount of the sidestream smoke per unit time, measured by the fishtail method. The amount of the sidestream smoke per cigarette is also shown in FIG. 7. Also, the amount of the visible sidestream smoke for each cigarette was measured by using the apparatus shown in FIG. 2, and the result is shown in Table 2 and FIG. 8. The experimental data support that, where the amount of potassium citrate is large, the burn time is long. However, since the amount of the sidestream smoke is prominently large (FIG. 7), the amount of the sidestream smoke per unit time, which was measured by the fishtail method, was large. On the other hand, if the amount of potassium citrate is increased, the burn time is shortened. However, since the amount of the sidestream smoke per cigarette is prominently decreased (FIG. 7), the amount of the sidestream smoke per unit time, which was determined by the fishtail method, was decreased, though the rate of decrease was not

prominently high. However, the experimental data given in FIG. 8 support that the amount of the visible sidestream smoke was prominently decreased by allowing the wrapper paper to contain at least 3% of potassium citrate.

Table 2

Wrapper paper	Amount of calcium carbonate (g/m^2)	Amount of burn adjusting agent (%)	Fish tail method			Amount of visible sidestream smoke
			Burn time sec/49 mm	Amount of sidestream smoke mg/cig	Amount of sidestream smoke mg/min.	
2-1	35	0.0	427	21.3	3.00	1.00
2-2	35	1.0	369	16.9	2.75	0.72
2-3	35	1.9	360	15.4	2.57	0.56
2-4	35	2.9	354	14.9	2.53	0.49
2-5	35	4.5	352	14.8	2.52	0.49
2-6	35	6.2	351	14.5	2.48	0.43

Example 3

Wrapping papers were prepared by adding varied amounts of potassium citrate as shown in Table 3 to the wrapper paper containing 30 g/m^2 of calcium carbonate which was found to permit markedly decreasing the amount of the visible sidestream smoke in Example 1. The other conditions were the same as those for Example 1. Table 3 also shows the burn time, the amount of the sidestream smoke per cigarette, and the amount of the sidestream smoke per unit time, measured by the fishtail method. The amount of the sidestream smoke per cigarette is also shown in FIG. 9. Also, the amount of the visible sidestream smoke for each cigarette was measured by using the apparatus shown in FIG. 2, and the result is shown in Table 3 and FIG. 10. The experimental data support that, where the amount of potassium citrate is small, the burn time is long. However, since the amount of the sidestream smoke per cigarette is prominently large (FIG. 9), the amount of the sidestream smoke per unit time, which was measured by the fishtail method, was large. On the other hand, if the amount of potassium citrate is increased, the burn time is shortened. However, since the amount of the sidestream smoke per cigarette is prominently decreased (FIG. 9), the amount of the sidestream smoke per unit time, which was determined by the fishtail method, was decreased, though the rate of decrease was

not prominently high. However, the experimental data given in FIG. 10 support that the amount of the visible sidestream smoke was prominently decreased by allowing the wrapper paper to contain at least 3% of potassium citrate.

Table 3

Wrapper paper	Amount of calcium carbonate (g/m^2)	Amount of burn adjusting agent (%)	Fish tail method			Amount of visible sidestream smoke
			Burn time sec/49 mm	Amount of sidestream smoke mg/cig	Amount of sidestream smoke mg/min.	
3-1	30	0.0	435	22.5	3.10	1.00
3-2	30	0.9	383	18.1	2.83	0.84
3-3	30	1.8	365	16.4	2.69	0.62
3-4	30	2.9	359	15.5	2.59	0.51
3-5	30	4.6	357	15.4	2.59	0.50
3-6	30	6.1	354	14.9	2.52	0.49

Reference Example 2

Wrapper papers A to C were prepared, containing the total ash components as shown in Table 4.

Wrapping paper A was a wrapper paper made by adding calcium carbonate used as a loading material to the wood pulp and by using a Fourdrinier machine in which a twin wire was substituted for a part of the wire part. Wrapping paper B was a wrapper paper made by the process similar to that for making wrapper paper A, except that its addition amount of calcium carbonate was larger than wrapper paper A. Further, wrapper paper C was a wrapper paper made by using the ordinary Fourdrinier machine such that its calcium carbonate content was made equal to that for wrapper paper A. Table 4 shows the result of the measurement in respect of the ash component in the surface layer and the ash component of the entire sample.

Table 4

	Paper machine	Total ash (%)	Ash in surface layer (%) T.S/B.S*
Wrapper paper A	On-top type Fourdrinier machine	30.0	30.8/27.3
Wrapper paper B	On-top type Fourdrinier machine	33.4	32.7/28.8
Wrapper paper C	Fourdrinier machine	30.9	36.9/23.8

*T.S/B.S : top side/bottom side

No problem was generated in the cigarette manufacture when it comes to wrapper paper A and wrapper paper B, which are made by using a Fourdrinier machine in which a twin wire was substituted for a part of the wire part. However, when it comes to wrapper paper C in which the ash content in the vicinity of the surface exceeded 35%, a large amount of the loading material was found to have dropped from the surface of the paper in the manufacturing process of the cigarette. The dropped paper powder formed a dust, and the wrapping defect was generated in the cigarette, with the result that it was difficult to manufacture the cigarette. Such being the situation, it has been found that the wrapper paper, in which the ash content in the surface layer exceeds 35%, is not suitable for use in the manufacture of the cigarette.

As described above, the present invention provides a wrapper paper for a smoking article, which permits significantly decreasing the amount of the sidestream smoke of the smoking article as measured by the visual observation.